INSIDER

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AMES LABORATORY 60 1947 • 2007

Holiday Auction a Record-Breaking Success

$4,205 goes to Shop with a Cop

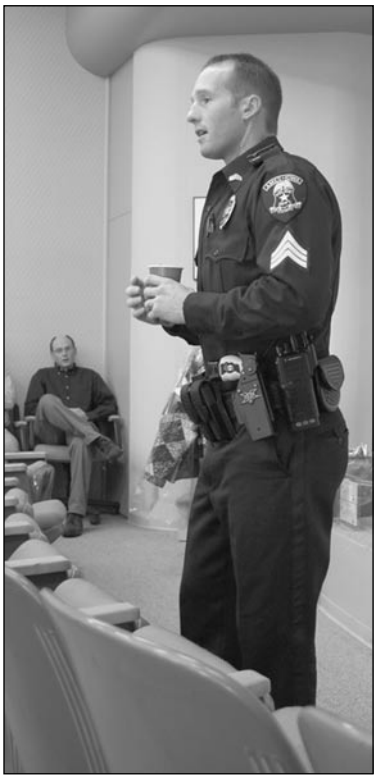
Outside snow was coming down, but inside bids were going up at the annual Ames Lab/IPRT Holiday Auction on Dec. 6. The auction brought in a record-breaking $4,205 dollars for this year's beneficiary, the Ames Police Benevolent Association's Shop with a Cop program.

According to Ames Police Sergeant Tom Shelton, this year the Ames Shop with a Cop program took 75 disadvantaged youngsters shopping on Dec. 15 to buy holiday gifts for themselves and their family members.

"In total, when you count the 75 kids who do the shopping and the families they buy gifts for, Shop with a Cop provided holiday gifts for 235 people who otherwise may not have had any gifts under the tree this year," said Shelton.

"We couldn't continue this valuable program without the help of organizations like Ames Laboratory and IPRT," added Shelton. "We are very thankful for your willingness to help support this worthy event."

John Hjortshoj's ever-popular office treats for a year created an exciting bidding war between a group of MEP staff and the Budget staff, Accounting staff and Mark Murphy. When the bidding reached $575, a sunglasses-wearing Santa burst into the room and made the MEP group's winning bid of $600.



Sergeant Tom Shelton says a few words about the Ames Police Benevolent Association's Shop with a Cop program, this year's auction beneficiary. "Shop with a Cop wouldn't exist without the support of local organizations like Ames Lab and IPRT," said Shelton.

The MEP staff were declared the winner, but Hjortshoj made the losing group an offer they couldn't refuse for another batch of treats for a year at the same price of $600. Applause broke out as Ila Haugen accepted the offer on behalf of Mark Murphy and the Budget and Accounting staffs.

Fast-talking Dale Meyer calls out the bids while Steve Karsjen holds a quilted wall hanging donated by Sue Tourtellott.

In addition to the funds raised for Shop with a Cop, Ames Lab and IPRT employees donated winter wear and food items that will go to Mid-Iowa Community Action. ■

Tom Wessels' bid makes him the winner of a hand-crafted miniature rocking chair donated by Cynthia Feller. "I'm doing my Christmas shopping," Wessels said.

Warm hats, mittens and scarves decorate the tree in Public Affairs collected for Mid-Iowa Community Action.

New Model Explains How Fuel-Cell Membrane Works

Researchers ID parallel cylindrical water nanochannels

Fuel-cell cars are reaching commercial viability in today's increasingly eco-conscious society, but despite their promise, even scientists have struggled to explain just how the fuel-cell's central component — the proton exchange membrane — really works.

However, Ames Lab chemists Klaus Schmidt-Rohr and Qiang Chen have offered a new model that provides the best explanation to date for the membrane's structure and how it functions. And armed with that information, scientists should be able to build similar fuel-cell membrane materials that are less expensive or have different properties, such as higher operating temperatures.

A fuel cell works by pumping hydrogen gas through the proton exchange membrane. In the process, the hydrogen gives up electrons in the form of electricity, then combines with oxygen gas to form water as the byproduct. It can also work in reverse — when current is applied, water splits into its component gases, hydrogen and oxygen.

The model proposed by Schmidt-Rohr and Chen, and detailed in the December issue of the journal *Nature Materials*, looked specifically at Nafion®, a widely used perfluorinated polymer film that stands out for its high selective permeability to water and protons. Schmidt-Rohr, who is also a professor of chemistry at Iowa State University, suggests that Nafion® has a closely packed network of nanoscale cylindrical water channels running in parallel through the material.

"From nuclear magnetic resonance, we know that Nafion® molecules have a rigid backbone structure with hair-like 'defects' along the chain," Schmidt-Rohr says, "but we didn't know just how these molecules were arranged. Some have proposed spheroidal water clusters, others a web-like network of water channels."

"Our theory is that these hydrophobic (water-hating) backbone structures cluster together," he continues, "to form long rigid cylinders about 2.5 nanometers in diameter with the hydrophilic 'hairs' to the inside of the water-filled tubes."

Though the cylinders in different parts of the sample may not align perfectly, they do connect to create water channels passing through the membrane material, which can be tens of microns thick. It's this structure of relatively wide diameter channels, densely packed and running mostly parallel through the material that helps explain how water and protons can so easily diffuse through Nafion®, "almost as easily as water passing through water," Schmidt-Rohr says.

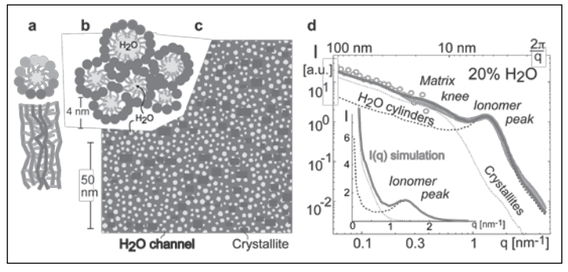
To unlock the structure mystery, Schmidt-Rohr turned to mathematical modeling of small-angle X-ray and neutron scattering, or SAXS/SANS. X-ray or neutron radiation is scattered by the sample, and the resulting scattering pattern is analyzed to provide information about the size, shape and orientation of the components of the sample on the nanometer scale.

Using an algorithm known as multidimensional Fourier transformation, Schmidt-Rohr was able to show that his model of long, densely packed channels closely matches the known scattering data of Nafion®. Mathematical modeling of other proposed structures, in which the water clusters have other shapes or connectivities, did not match the measured scattering curves.

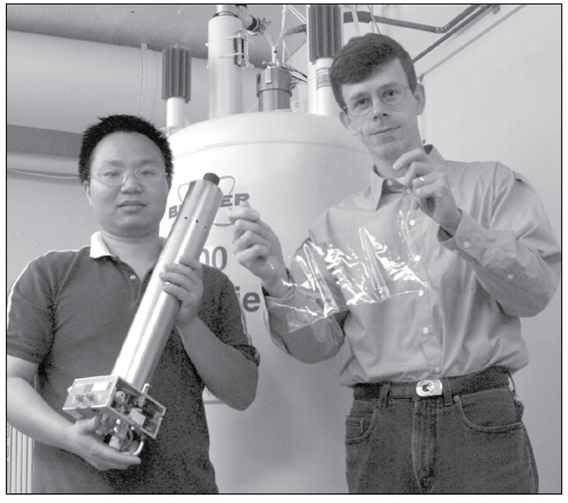
"Our model also helps explain how conductivity continues even well below the freezing point of water," Schmidt-Rohr says. "While water would freeze in the larger channels, it would continue to diffuse in the smaller-diameter pores."

Schmidt-Rohr adds that additional analysis is needed to determine how the cylinders connect through the membrane. ■

~ Kerry Gibson



(a) Two views of an inverted-micelle cylinder, with the polymer backbones on the outside and the ionic side groups lining the water channel. Shading is used to distinguish chains in front and in the back. (b) Schematic diagram of the approximately hexagonal packing of several inverted-micelle cylinders. (c) Cross-sections through the cylindrical water channels (grey) and the Nafion® crystallites (black) in the noncrystalline Nafion® matrix (dark grey), as used in the simulation of the small-angle scattering curves in d. (d) Small-angle scattering data (circles) in a log(I) versus log(q) plot for Nafion® at 20 vol% of H_2O, and the simulated curve from the model shown in c (solid line). The inset shows the ionomer peak in a linear plot of I(q). Simulated scattering curves from the water channels and the crystallites by themselves (in a structureless matrix) are shown dashed and dotted, respectively.



Klaus Schmidt-Rohr (right) and graduate student Qiang Chen stand in front of the nuclear magnetic resonance chamber. Tiny samples of Nafion® membrane are placed in a probe, which Chen is holding, and lowered into a high magnetic field within the chamber.

Ames Lab Graduate Student Gives Winning Presentation

Matt Vannette's talk chosen as best at Conference on Magnetism and Magnetic Materials

Matthew Vannette, a graduate student working in the Condensed Matter Physics program, won the Best Student Presentation award at the 2007 Conference on Magnetism and Magnetic Materials, Nov. 5-9 in Tampa, Fla. The award recognizes and encourages excellence in graduate studies in the field of magnetism and consists of a one-year fellowship of $1,000.

Vannette's award-winning presentation, "Distinguishing Local Moment vs. Itinerant Ferromagnets: Dynamic Magnetic Susceptibility," was selected from an international field of approximately 1,000 graduate students. His work represents new physics using a unique device called a tunnel diode resonator, or TDR, an extremely stable self-resonating circuit.

Vannette's work has shown that TDR measurements offer a means of determining whether a ferromagnetic system is local moment or nonlocal (itinerant) in its behavior. The discovery is significant because both forms of magnetism can exist in metals, and it's extremely difficult to determine experimentally the difference between the two. However, models of magnetism depend on whether a system is local or itinerant.

The difference between local moment magnets and itinerant magnets is where the electrons that carry the magnetism reside in the solid material. In local moment magnets, the magnetic electrons live near the ions that make up the solid. However, in itinerant magnets, the magnetic electrons live in what is called the conduction band, where they are free to move and transfer a charge. Itinerant magnets, such as nickel, are conductors, while local moment magnets, such as gadolinium, can be insulators.

"When I first started putting different materials into the tunnel diode resonator, I noticed that local moment magnets showed one very easily understood behavior, but itinerant magnets showed a very different behavior," says Vannette. "The data we collect using this technique allows us to discriminate between the two for whatever reason, and we're on the verge of learning how to interpret the data to understand what that reason might be."

Ruslan Prozorov, an Ames Lab physicist and Vannette's major professor, says, "The TDR has been used traditionally mostly for studying superconductors. Matt is the first to apply the TDR to the study of magnetic materials. It's totally his work and a completely new development in experimental physics. Until now, it was difficult and often ambiguous to determine if a system was local or itinerant. We've just scratched the surface with this work; it has to be developed and understood in detail," Prozorov adds.

Matthew Vannette poses with conference officials after being selected as the winner of the Best Student Presentation Award at the 2007 Conference on Magnetism and Magnetic Materials. (left to right) Kai Liu, program co-chair; Kaizhong Gao, awards coordinator; Vannette; Jan-Ulrich Thiele, program co-chair; and Dieter Weller, conference chairman.

The ability to distinguish between local and itinerant ferromagnetic systems using the tunnel diode resonator is a tremendous scientific advancement, but Vannette has an additional reason to be pleased. "It's not just the local/itinerant discovery, but also using the tunnel diode resonator to its fullest extent," he says. "In the magnetic system, there are so many effects going on that we need to understand."

A professional journal article about Vannette's work in which he is listed as the first author has been accepted for publication in the April 2008 *Journal of Applied Physics.* ■

~ Saren Johnston

Lograsso Named Materials and Engineering Physics Program Director

Thomas Lograsso has been appointed director of the Materials and Engineering Physics, or MEP, program. His appointment was effective Dec. 1, 2007.

Lograsso has been serving as interim director of the Lab's MEP program since March 2007. He has led the effort to reorganize the MEP program to more strongly align with the mission of the Division of Materials Science and Engineering within the DOE's Office of Basic Energy Sciences, or BES. The restructuring effort has been directed toward strengthening the focus of the MEP program, creating new research thrusts and organizing core research programs that are prepared to respond to future BES priorities.

Alan Goldman, Ames Laboratory interim director, praises Lograsso for his contribution to reorganizing the MEP.

"Tom has played a critical role in helping Ames Laboratory better position itself to respond to the core research areas of the DOE," says Goldman. "The Laboratory is better positioned now than ever before to play a critical role in helping solve our nation's energy challenges."

Lograsso has been a materials scientist at Ames Laboratory since 1988. Among his research interests is the understanding of the synthesis–property relations in highly responsive materials. He pursues this interest through the synthesis of bulk single crystals of intermetallics, martensitic, magnetoresponsive and quasicrystalline alloys.

"I am honored to have the opportunity to direct the MEP program on a more permanent basis," says Lograsso. "Finding opportunities in support of the DOE's mission will remain our focus." ■

~ Steve Karsjen

Scenes from the Holiday Auction

Sandi Bishop dishes up some pie for auction-goers like Heather Schilmoeller, intern in the Public Affairs office.

Vickie Hahn surveys the silent auction items up for bid.

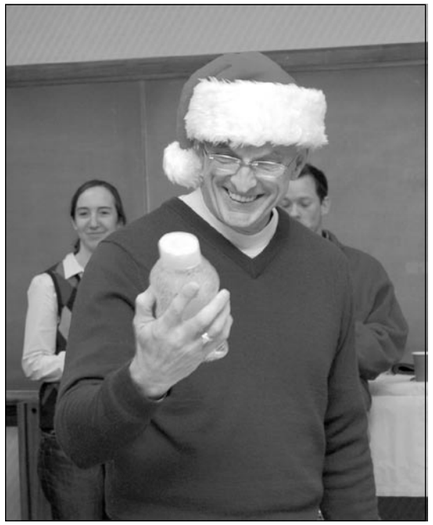
(left to right) Richard Malmquist, Alex Burgher and Greg Harper enjoy slices of pie while they wait for the live auction to begin.

Mark Murphy serves up treats for (left to right) Vickie Hahn, Barb Thompson and Karen Huiatt.

Three ladies in festive red holiday sweaters (left to right): Rhonda Hill, Cynthia Feller and Lynnette Witt.

(left to right) Susan Elsner, Carol Smith and Bev Carstensen ponder making a bid.

Generous Ames Lab and IPRT employees settle up after the auction.



Steve Karsjen finds himself the big winner of a bottle of "mega, mega hold" hair gel (thanks to a "proxy" bidder who remains anonymous).

Alan Goldman (left) and Tom Wessels share some holiday cheer.

Deb Samuelson (left) and Saren Johnston record the winning bids and bidders during the auction.

The crowd celebrates another big winning bid.

A mysterious Santa (later revealed to be rare-earth metals technician Dave Boeke) enters the bidding war for the popular "office treats for a year" donated by John and Sharon Hjortshoj.

Rehbein Runs for American Legion National Commander

Top job will cap off 33 years of Legion service

Dave Rehbein is traveling the country, making campaign stops in each state to shake hands and talk to folks about why he would like to be elected their national leader in 2008. No, Rehbein isn't running for president of the United States, but he is in the middle of a busy national campaign. Next August, Rehbein, Ames Lab assistant metallurgist, will be on the ballot for National Commander of the American Legion, the top post in the 2.75-million member organization for wartime veterans.

Before the election, Rehbein is visiting Legion groups from coast to coast and aims to visit each state in the union. So far he's made trips to 22 state Legion meetings to talk about his vision for the organization's future and learn more about what is important to Legion members in various parts of the country.

"I hear different stories and concerns around the country," says Rehbein. "Some things are more important in different places, just because of local conditions. But as a national Legion leader, I will need to know all these concerns from all 50 states."

As National Commander, Rehbein, who is currently running unopposed, will be the chief executive officer and primary spokesman for the Legion. He will spend his time working on the organization's legislative priorities and promoting the four "pillars" of Legion activities: ensuring Veteran's Administration funding, upholding national security, providing educational activities and promoting patriotism.

The job will keep Rehbein on the road an exhausting 300-plus nights for the year of his term, but his most important goal for the American Legion will keep him energized.

"Right now, Legion membership doesn't look like the current military, and I'm going to work very hard to connect Legionnaires to what the military looks like now," says Rehbein. "Frankly, current Legion members have come to be known as old, white and male, but the current military is much more diverse than that. A third of the Navy is female, many veterans coming home from Iraq and Afghanistan are in their mid twenties, and we have all races represented in the military today. My message will be that even if soldiers coming home from war today look different than longtime Legionnaires, every soldier is the same on the inside. And all veterans are welcome in the American Legion."

Drafted into the Army in 1969, Rehbein was an infantryman for two years with the 4th and 1st Armored Divisions in Germany. In 1971, he was discharged at the rank of Sergeant E-5. And then his life in the American Legion began.

"I went to a couple of post meetings here in Ames and got elected to my first officer position. And now, 33 years later, here I am running for National Commander," Rehbein says.

Rehbein has served in Legion positions ranging from local Post #37 newsletter editor to Iowa's representative on the Legion's National Executive Committee and the chairmanships of three national committees. During his term as state membership chairman, Iowa achieved target membership increases in 1991, 1992 and 1993. He was appointed by former Iowa Gov. Tom Vilsack to a position on the Iowa Commission on Veterans Affairs in 2006. In early December, Rehbein's Legion duties took him to Cuba where he had the unique opportunity to observe a hearing at Guantanamo Bay (see sidebar).

The Legion and Legion Auxiliary, a group for veterans' female family members, are a family affair for Rehbein. Rehbein's daughter Jennifer, a Navy veteran, is the president of the local Legion Auxiliary unit and is also a member of the Legion post. His wife has been active in the Legion Auxiliary since she was "about an hour and a half old," as Rehbein says and is a Past State President of the Auxiliary. Their son, Chris, is also active in the Sons of the American Legion.

"I owe a great deal to my wife, Ann, and our two kids for their understanding and support all these years I've been in the Legion," Rehbein says.

Rehbein also credits the Ames Laboratory community for supporting his Legion service. What will be the Legion's gain will be the Lab's loss. Rehbein will retire in July so he can focus fully on the job of National Commander.

"I have been fortunate to spend my career here at Ames Lab," says Rehbein. "I've worked for a number of people at the Lab who understand the importance of community service." ■

~ Breehan Gerleman Lucchesi

Visit to Guantanamo Bay

Dave Rehbein talks about his experience as an official observer at a hearing at Guantanamo Bay. The U.S. military invited a representative of the American Legion to observe the recent hearing to determine the enemy combatant status of Salim Ahmed Hamdan, Osama bin Laden's driver. As next in line for Legion National Commander, Rehbein was chosen to travel to Cuba to witness the Dec. 3-7 proceedings. He walked away from the 21-hour hearing with the impression that the process seemed fair.

"The trial felt like a trial anywhere, except for the heavy presence of military police officers in the room," says Rehbein. "There weren't a lot of objections, and everything said in the courtroom was simultaneously translated into Arabic for Hamdan."

When Rehbein returned to Ames, he gave an informal talk about his experiences to some of his colleagues in Metals Development.

"The press isn't covering the Guantanamo Bay hearings as much here in the Midwest, so I'm working hard on getting the word out about what I saw while I was there," says Rehbein. "I was really impressed with all the military personnel I came in contact with. A large number of the people on the base are deployed from the National Guard and Reserve forces from all branches of the military — Army, Navy, Marines, Air Force and Coast Guard — and everyone is doing a great job."

Around the World and Back Again

Former SULI intern returns to Ames Lab

It's not true that "you can't go home again." Just ask Travis Monk, whose journey back to the Ames Laboratory involved a couple of years, the completion of two degrees and a stay in a foreign country. But in the end, at least temporarily, he's home again at the Lab conducting interesting and important research.

Monk was an undergraduate from Truman State University when he arrived at Ames Lab for the first time in May 2005. He was one of 10 student interns who participated in the Lab's Science Undergraduate Laboratory Internship, or SULI, program that summer. During his 10-week internship, he worked in physicist Kai-Ming Ho's program where his job was to fabricate photonic crystals.

"It turned out that he (Monk) was really among the good people we had for undergraduate interns," says Ho. "We quickly added him to our active recruit list for graduate school at Iowa State Universtiy."

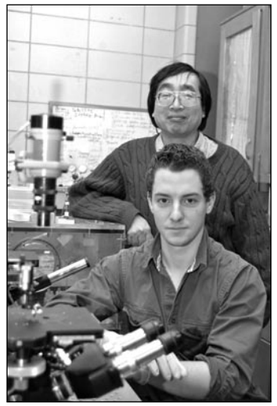
But graduate school at ISU was not to be in the cards for Monk upon completion of his undergraduate degree at Truman State in May 2006. Instead, due to his desire to pursue a master's degree in neuroscience rather than physics, his plans for getting that degree would lead him thousands of miles away from the Midwest. His destination: the University of Plymouth in Plymouth, England. In September 2007, following one year of intensive study and completion of his thesis, he graduated from the University of Plymouth with a master's in neuroscience.

Upon receiving his master's degree, Monk once again found himself making decisions about his future. This time, he had to decide where to complete his Ph.D. In the end, he was accepted into the neuroscience program at the University of Otago, Dunedin, New Zealand, but there was one hitch: he couldn't begin until February 2008.

"I had some downtime between September and February; I had nothing to do; England was expensive; I was in debt, and I needed a job," says Monk. "So I contacted Dr. Ho with whom I'd worked in 2005. I told him I needed a couple of months of internship, and I was interested in working for him. He offered me a job."

So on Oct. 6, 2007, Monk found himself right back at the Ames Lab in an internship involving work on a project similar to the one he'd worked on in 2005.

"I'm basically doing the same work as I was in 2005 fabricating crystals, but this time I'm focusing on one particular application for photonic crystals, which is using them as a substance-identification device," he says.



Monk credits the SULI program with providing him the framework to succeed. "I believe it's because I demonstrated to Dr. Ho that I could do good work while I was in the SULI program that he was so willing to offer me a job when I asked," says Monk. But that's not the only reason Monk is so high on SULI. The program also provided him an opportunity to really figure out what he wanted to do.

"When I arrived at the Lab in 2005, I thought I had my career path laid out. I was interested in theoretical physics, came here and did a project in experimental physics with Dr. Ho, and my career path changed," he says. "I'm living proof that the SULI program really helps."

SULI really helps scientists too, says Ho, who credits the program with introducing him to a student he's been able to bring back to the Lab to help perform cutting-edge research in his program. And although things didn't quite work out as he'd hoped in that Monk didn't decide to come to ISU for graduate school, he says the SULI program did serve its "global" purpose, which is to get students like Monk to see the value in attending graduate school.

"It's a way for students to see what real research looks like," says Ho. "But also it's a way for university scientists to show students how much fun it is being a graduate student and for us to have a channel to reach top students."

Monk's current opportunity at Ames Lab will continue only a few more months and then he'll be off to New Zealand and the next leg of his education journey. But Ho's and the SULI program's investment in him is something that will likely resonate with Monk throughout his entire career. Is there a chance that Monk might find his way back to Ames Lab and ISU again some day? Quoting Monk, "If neuroscience doesn't work out, I can always go back to physics." ■

~ Steve Karsjen

SC07 Conference

Photo by Sarom Sok

Jordan Hager, Scalable Computing Lab research helper, mans the SCL booth at the SC07 conference in Reno, Nev. Scalable Computing staff attended the SC07 conference Nov. 10-16 where they showcased their work in assessing and improving the overall performance of high-performance computing applications on today's high-end massively parallel supercomputers.

SC is an annual conference that showcases how high-performance computing, networking, storage and analysis leads to advances in research, education and commerce. Mark Gordon's GAMESS software was featured in the SC07 Cluster Challenge at the conference. GAMESS, a computational chemistry software package, was one of several software applications used in the competition that brings teams of undergraduate students together to assemble a small computer cluster; run applications, like GAMESS; and compete for the best speed and throughput.

Smiling Faces at Shop with a Cop





The smiles say it all — the 2007 Shop with a Cop event was a great success! On Dec. 15, local police officers and 75 eager young shoppers descended on K-Mart to eat breakfast and shop for gifts for themselves and their families. Afterward, the shoppers went to the Boys and Girls Club where cops and other volunteers, including the Ames Lab Public Affairs staff, helped wrap the presents.

Happy Holidays

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Address comments to:
Editor, ***INSIDER***
111 TASF
Ames, IA 50011-3020
515/294-9557
FAX 515/294-3226

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Editor Breehan Gerleman Lucchesi
Layout Tiffany Woods

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